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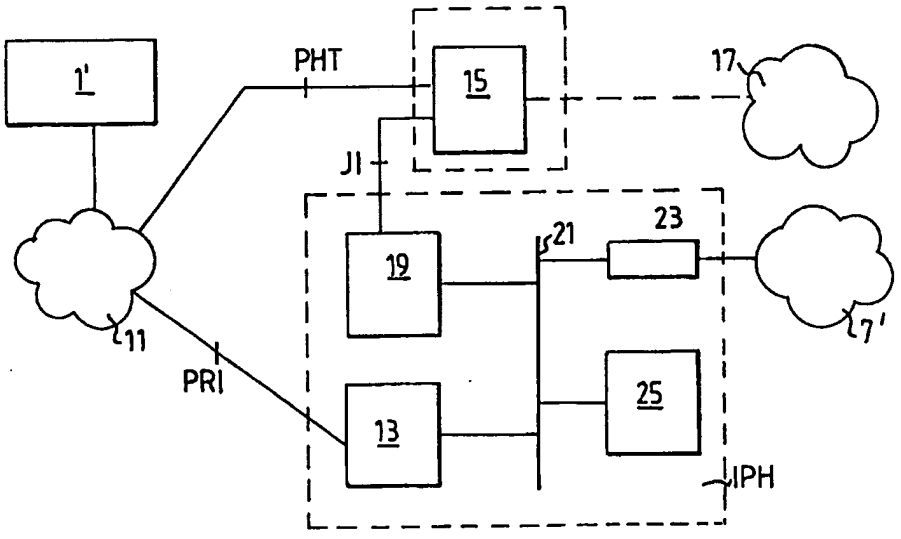

(57) Abstract

A method and an apparatus are described which enable a connection with a variable bandwidth from a subscriber terminal in an Integrated Services Digital Network (ISDN) to a data network, such as the Internet. The D channel or one or both B channels may be used, and the bandwidth may be adjusted while the connection is maintained, by connecting and/or disconnecting channels, in dependence of the data traffic requirements and the need for the B channels for telephony purposes.

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METHOD AND DEVICE IN ISDN NETWORK

Technical Field

The present invention relates to a method and an apparatus for data communication, and in particular to a method and an apparatus for allowing 128 kbit/s data traffic on an Integrated Services Digital Network (ISDN) connection.

Background

With the introduction of Internet-related services the use of telecommunications services has changed noticeably in recent years. The Public Services Telephone Network (PSTN) and ISDN lines are being used to an increasing degree for data communication, for example for interactive communication with the world wide web, or for downloading data files. On ordinary telephone lines, these operations may take several hours, during which the telephone lines will be occupied.

For large companies, dedicated leased lines constitute a flexible and cost effective solution to this problem. For smaller companies and for individuals this will not be feasible because of the relatively high cost. For these user categories, PSTN telephone lines or ISDN connections may be the only realistic solution.

An ISDN connection offers three channels on the same physical link: two circuit switched B channels of 64kbit/s each for dial-up access for data or speech connections and one packet switched D channel. The total bandwidth of the D channel is 16 kbit/s, but the effective capacity for control information or data is 9.6 kbit/s. A protocol known as LAPD (Link Access Procedure for D channel) is used for communication on the D channel.

If only one B channel is used for data communication, the free B channel may at the same time be used for incoming calls. This however, limits the available bandwidth for data traffic to 64 kbit/s. If both B channels are used for data communication, no incoming calls may be received.

One solution to this problem is to forward incoming calls to another destination, typically the user's mobile telephone, when both B channels are being used for data communication. This solution requires an extra telephone subscription.

Summary of the Invention

It is an object of the present invention to allow users to use both B channels in an ISDN connection for data communication while still allowing them to accept incoming calls if desired without the need for another telephone subscription.

This object is achieved according to the invention by using the D channel for signalling purposes when using both B channels at the same time for data communication. Incoming calls may be registered on the D channel in the normal way, and may be handled in any of the following ways:

- the calls may be put through to the subscriber by default
- the caller may get busy signal or be forwarded to an answering service
- the subscriber may have specified beforehand certain callers who are to be put through. The rest may then get line busy signal or be forwarded to an answering service.
- the subscriber may be notified about each incoming call, and for each call may decide whether or not he wishes to answer.

If a call is put through, one of the B-channels are temporarily disconnected from the data flow and used for a speech connection. If desired, both B-channels may be temporarily disconnected and only the D-channel used as a connection for data communication.

If the call is rejected, the caller may be allowed to leave a message, for example with voice mail.

The solution according to the invention offers the following advantages to the end user:

- A flexible Internet search tool based on the standard ISDN interface, which may be implemented at a reasonable cost.
- The user can control the quality of service by selecting the bandwidth of the IP channel.
- The full bandwidth of the ISDN subscription may be used for data traffic, while one or both 64 kbit/s lines are still continuously available for incoming telephone calls.
- Ongoing data traffic will not be interrupted if an incoming call is answered. The traffic will, however, be slowed down while the call lasts.
- Incoming calls may be connected to an answering service for the ISDN connection.

Brief Description of the Drawings

Figure 1 illustrates schematically the connection from the ISDN subscriber via the ISDN network to the Internet according to the invention;

Figure 2 illustrates the connection from the ISDN subscriber via the ISDN network to the Internet in more detail;

Figure 3 is a flow chart of the actions required to install and activate the services according to the invention; and

Figure 4 is a flow chart of the actions required to connect to the Internet according to the invention.

Detailed Description of Embodiments

Figure 1 shows an ISDN connection to a computer network for retrieving data according to the invention. In a preferred embodiment, the computer network is a network providing communications across multiple networks, commonly referred to as the Internet, but similar connections may be set up to any computer network, for example a network which allows an X.25 or Internet Protocol (IP) connection. An enhanced ISDN terminal known as a PMMX (Personal Multimedia Exchange) 1 is connected to an ISDN exchange 3. The ISDN exchange is connected via an Internet

access server 5 to the computer network 7. Other servers 9 are connected to the data network as well.

The PMMX is a workstation, a Personal Computer (PC) or a local router, configured as described in connection with Figure 3.

The PMMX does not have a fixed IP address, but obtains an IP address from the IP handler each time a connection is set up. The IP address is returned each time a connection is ended.

The PMMX contains a user interface for the handling of the three ISDN channels and for handling operation and maintenance functions in the network, and also contains functions for utilizing the Internet Protocol (IP) interface included in the PC, workstation or router used.

A user may log in to the PMMX with a user identity and a password, or in any other way known in the art, for example with voice recognition.

Figure 2 shows the connection from a subscribers PMMX 1' to a data network, which in this embodiment in the Internet 7' in more detail. As before, the PMMX is used to handle the two B channels and the D channel of an ISDN connection. The PMMX 1' is connected to an ISDN network 11, comprising at least one ISDN exchange.

The ISDN network 11 is in turn connected via a 2 Mbit/s PRI (Primary Rate Interface) to an ISDN router 13 for connecting the two B channels to the Internet 7'.

The ISDN network 11 is also connected via a PHI (Packet Handler Interface) to a packet handler 15, which may be an ordinary packet handler used as a gateway to an X.25 network 17. The packet handler is connected via an interface I1 to a D channel router 19 for connection to the Internet 7'. The connection from the ISDN network

11 via the packet handler 15 and the D channel router 19 is used for the data transmission on the D channel. It will be obvious to the skilled person that the ISDN router and the D channel router may be implemented as one unit.

The ISDN router 13 and the D channel router 19 are connected via an Ethernet connection 21 to a router 23, which is connected to the data network 7', and connection means 25 for authentication of the user and activation of the IP address and other IP parameters. For an Internet connection, the means 25 will comprise a Dynamic Host Configuration Protocol (DHCP) server, a Remote Authentication Dial-in User Service (RADIUS) and a Domain Name Server (DNS) 25.

The ISDN router 13, the D channel router 19, the router 23 and the connection means 25 constitute the Internet packet handler IPH. For connection to another data network than the Internet, the router 23 and the connection means 25 would have to be adapted to this kind of data network.

In this way, the D channel may be used as a permanent connection to any data network, for example, the Internet. However, this channel is also needed to control the use of the two B channels. This is solved by utilizing the fact that the D channel is a packet switched channel, with a well defined protocol: the LAPD (Link Access Procedure for channel D). The ability to use the D channel for transfer of user data is defined in the ISDN standard X.31.

The header information in each packet transmitted on the D channel includes, in the Service Access Point Identifier (SAPI) field, information about the type of information included, according to the LAPD protocol. Control information for the B channels is denoted "0" in the SAPI field. Data communication, for example with the Internet, which should simply be transmitted through the ISDN exchanges, is denoted "16" in the SAPI field.

In a preferred embodiment, the connection between the PMMX and the packet handler is set up by dialling the number of the packet handler. Then all packets intended for the packet handler are marked with "16" in the SAPI field, so that they will be transmitted through the telephone network 11 directly to the packet handler.

In another embodiment, certain major networks, such as the Internet, may be identified by individual digits in the LAPD protocol. For example, data packets intended for the Internet might be identified by the digit "17", which is currently not used in the LAPD protocol. In this embodiment it would not be necessary establish a connection to a packet handler; all cells with the digit "17" in the SAPI field would automatically be transmitted to the data network.

In this way, the channel may be used for data communication and then, when the need arises, for control information about the B channels, by including one or more data packets identified as intended for the switch, while still maintaining the data connection to the Internet, as shown in figure 1.

Figure 3 is a flow chart of the actions to be taken to install the PMMX software.

Step 100: The ISDN terminal is installed and configured in the way common in the art.

Step 102: The additional software and hardware needed in the PMMX is installed.

Step 104: The PMMX monitor, which is the management application used to control the function of the ISDN is installed.

Figure 4 is a flowchart of the actions to be taken when a subscriber wishes to connect and log in to the Internet according to the invention.

Step 110: The user initiates the connection to the Internet Packet Handler (IPH). This will normally be done by clicking on an icon on the computer

screen, or by entering a command through the user interface, which will initiate the dialling of the number to the packet handler.

Step 112: The connection procedure is performed over the D channel to the IPH using X.31 specifications.

Step 114: The user identifies himself by entering the appropriate user identity and password. The user identity and the password may be stored on any medium, such as a smart card or a data file, or it may be typed by the user.

Step 116: When the connection between the PMMX and the IPH has been set up, the control protocol negotiation will be performed to establish a connection of the desired bandwidth.

Step 118: User authentication is carried out by the connection means 25, based on the identification offered in step 114.

Step 120: The PMMX requests the necessary parameters.
When connecting to an IP (Internet Protocol) network, this request is based on the Request for Comment (RFC) concerning DHCP.
At least the following parameters are requested and updated from the IPH-DHCP server:
- IP address
- IP subnetmask
- Gateway IP address
- DNS address

Step 122: The PMMX prompts the user to enter the desired bandwidth of the connection. The bandwidth may be specified as 16 kbit/s (D channel

only), 64 kbit/s (one B channel), 128 kbit/s (both B channels), or to be controlled by the PMMX according to the data flow at any moment.

Step 124 The user is also prompted to specify what should happen if a B channel used for data communication is at any time wanted for another connection, for example if the phone rings. The options may be, for example, to answer all calls, to reject all calls, answer only calls from certain specified numbers, or, for each incoming call, to show the calling number on the screen and let the subscriber decide for each call.

Step 126: The connection between the PMMX and the data network is set up.

In step 116, the de facto standard protocol today for use together with the IP is Point-to-Point Protocol (PPP). This also enables the authorization in step 118 to be carried out by the connection means 25.

When the 128 kbit/s connection has been set up, both B channels are occupied for the Internet connection. If the subscriber wishes to use one B channel, for example to make a phone call or send a fax, he informs the PMMX about this, and the PMMX then makes one B channel available by disconnecting it from the data connection. The other B channel is still used for data communication.

If the subscriber wishes to use both B channel at the same time, he informs the PMMX about this, and the PMMX makes the other B channel available by disconnecting it from the data connection. The D channel is then used for data communication, to maintain the connection. In this way, the data connection is maintained even when both B channels are being used for other purposes.

The PMMX may be informed that the subscriber wants to use the B channels in different ways. The information may be entered via the user interface of the PMMX, or the subscriber may simply lift the handset of his telephone or dial a fax number.

If an incoming call is received, it is handled as specified in step 124.

Claims

1. Method for sending and/or retrieving data using an ISDN connection comprising two circuit switched channels (B channels) and one packet switched channel (D channel), using an ISDN terminal for controlling the channels, **characterized** by the following steps:

- Using the D channel for controlling the B channels and for sending and/or receiving data, by means of the LAPD protocol
- Specifying the use of the channels via the ISDN terminal, according to one of the following:
  - both B channels used for data communication
  - one B channel used for data communication
  - only D channel used for data communication
  - D channel, one B channel or two B channels used for data communication, in dependence of the traffic and on any incoming calls on the connection

2. Method according to claim 1, **characterized** by specifying for each incoming call whether the call should be accepted or rejected and that a default way of handling incoming calls is specified.

3. Method according to claim 1 or 2, **characterized** in that for any incoming call, the calling telephone number is displayed to the user before the action to be taken is determined.

4. Method according to claim 1 or 2, **characterized** in specifying in advance the phone and/or fax numbers from which calls should be accepted or rejected, the ISDN terminal handling any incoming calls according to this specification, and specifying a default way of handling incoming calls.

5. Apparatus for sending and/or retrieving data using an ISDN connection controlled by an ISDN terminal comprising two circuit switched channels (B channels) and one packet switched channel (D channel), in which an ISDN terminal is used for controlling the channels, **characterized** in that the ISDN terminal comprises

- control software to allow the selection of the desired bandwidth by using the D channel, one B channel or both B channels respectively

6. Apparatus according to claim 5, **characterized** in that the ISDN terminal comprises software which allows the user to specify for each incoming call whether it should be accepted or rejected, and a default way of handling incoming calls, and to handle incoming calls accordingly.

7. Apparatus according to claim 5 or 6, **characterized** in that the ISDN terminal is adapted to display the calling telephone number of any incoming call to the subscriber and handle the call as specified.

8. Apparatus according to any one of the claims 5-7, **characterized** in that the ISDN terminal comprises software which allows the user to specify in advance the phone and/or fax numbers from which calls should be accepted or rejected, that that the ISDN terminal handles any incoming calls according to this specification.

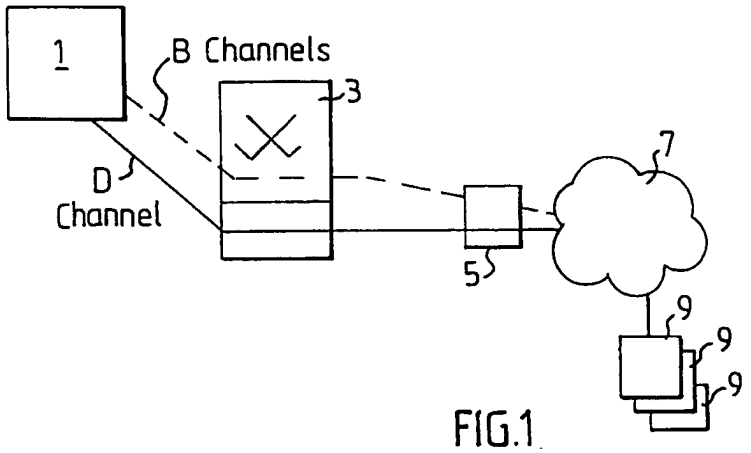
1
B Channels
3
D
Channel
5
7
9
9
9

FIG.1

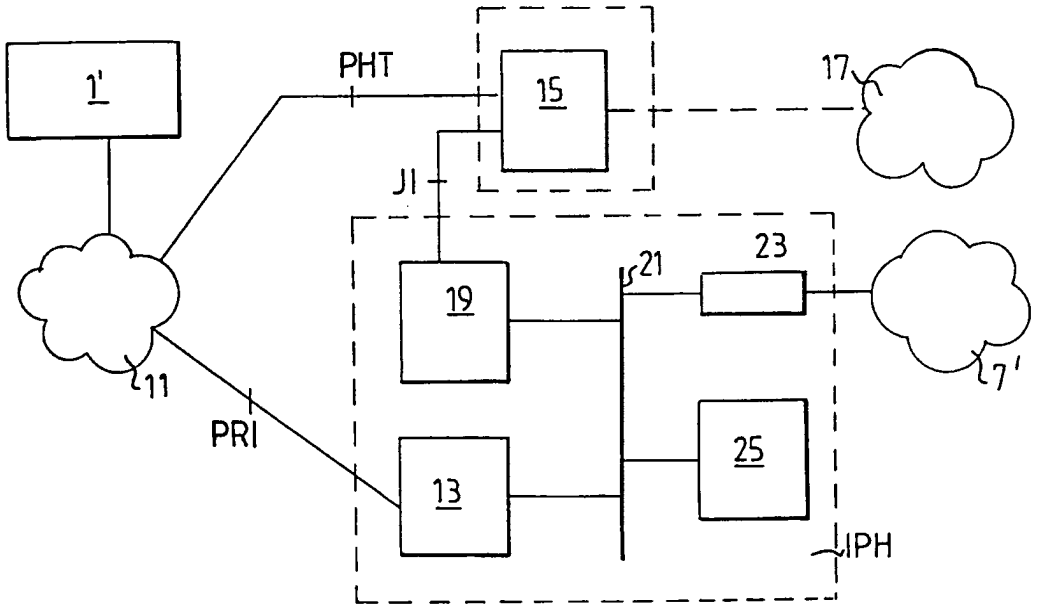
1'
PHT
15
17
J1
19
21
23
11
PRI
13
25
IPH
7'

FIG. 2

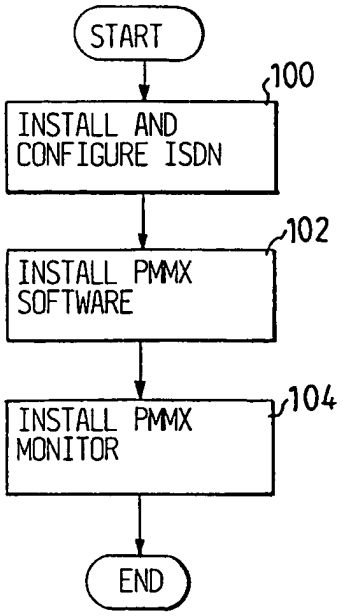
START
100
INSTALL AND CONFIGURE ISDN
102
INSTALL PMMX SOFTWARE
104
INSTALL PMMX MONITOR
END

FIG.3

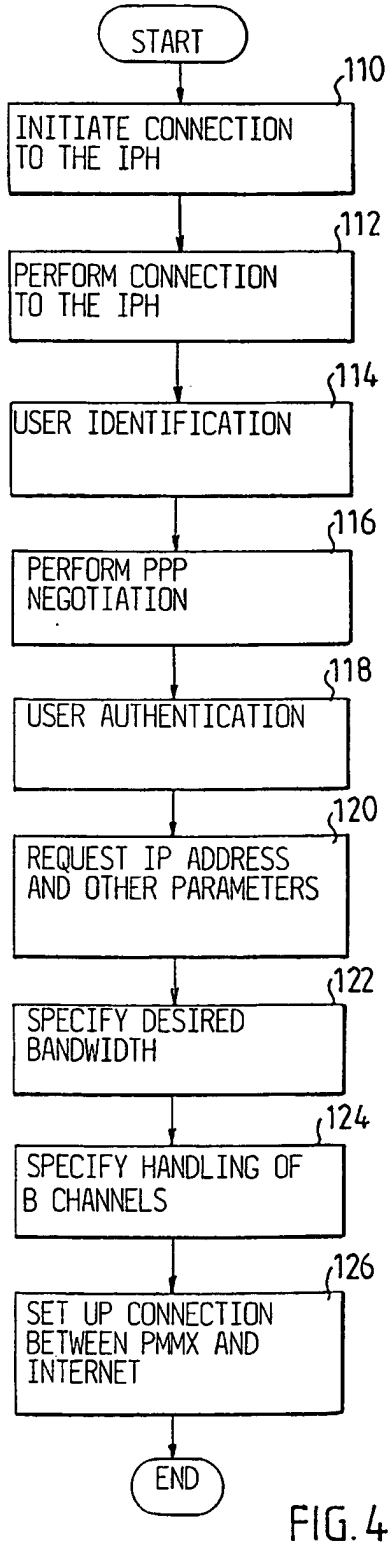
START
110
INITIATE CONNECTION TO THE IPH
112
PERFORM CONNECTION TO THE IPH
114
USER IDENTIFICATION
116
PERFORM PPP NEGOTIATION
118
USER AUTHENTICATION
120
REQUEST IP ADDRESS AND OTHER PARAMETERS
122
SPECIFY DESIRED BANDWIDTH
124
SPECIFY HANDLING OF B CHANNELS
126
SET UP CONNECTION BETWEEN PMMX AND INTERNET
END

FIG.4